Signal Training Bulletin

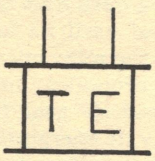
COMMITTEE G: Education & Training
Communication & Signal Division, AAR

C-12 Time Element Relays—Motor and Electromagnetic

Approved October 1973

Definition: Time Element Relay: A relay which will not close its front contacts or open its back contacts, or both, until the expiration of a definite time interval after the relay has been energized.

Symbol:



Description: The motor type of time element relay described is of simple construction and contains a constant speed motor with enclosed gear train, a pair of holding coils and a calibrated timing gear wheel with a check and timing contacts. The electromagnetic type time element relay has two operating coils and two small auxiliary coils. The time interval is obtained by the oscillating motion of the oscillating armature which is converted to a rotary motion by means of a ratchet wheel, and pawl which drive a set of planetary gears.

Figures 1(a) and 1(b) illustrate a motor and electromagnetic time element relays.

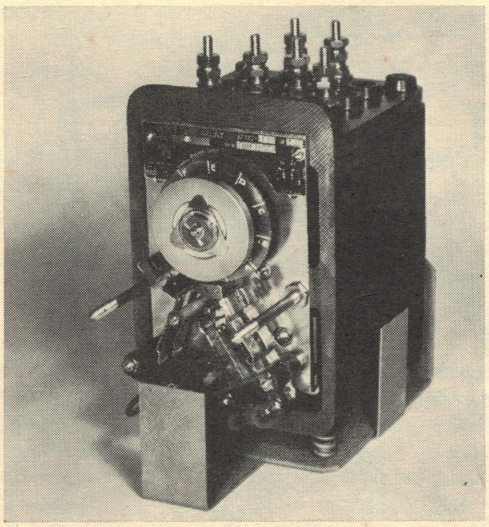


Figure 1 (a): Motor-operated time-element relay.

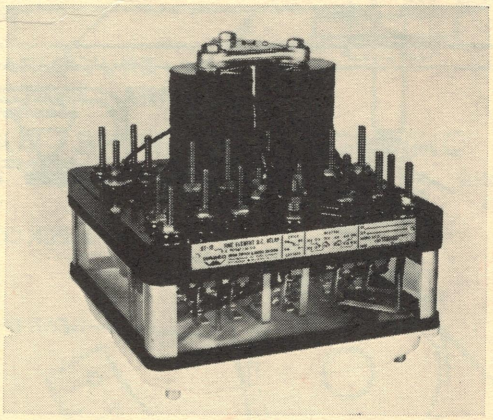


Figure 1 (b): Electromagnetic time element relay.

Purpose and Application: The motor of electromagnetic operated time element relays are used in approach timing at interlockings, automatic interlockings, highway crossing signals, or any other application where accurate, dependable timing is required.

Various railroads use time elements for train speed timing in conjunction with highway crossing signal approach starts. This practice requires a very accurate timing device. Basically, circuits provide for a separate start for maximum speed trains and lower speed trains by means of a timing section which initiates the start of a timing relay. This timing section is in approach to maximum speed start and if a train uses more time moving through this timing section than the time calculated for such movement by a lower speed train, the timing relay completes its cycle of operation and energy remains on the approach control circuit.

At interlockings, lift bridges, and ctc (centralized traffic control) control points, time element relays are normally used for time locking. After initially clearing a home signal over a route and then restoring this same signal back to stop, without a train movement, provision must be made so that the original route cannot be changed until a pre-determined time cycle has expired. This prevents the throwing of a switch or clearing a conflicting signal in front of an oncoming train that has passed a clear approach signal expecting to find the home signal displaying an aspect other than stop.

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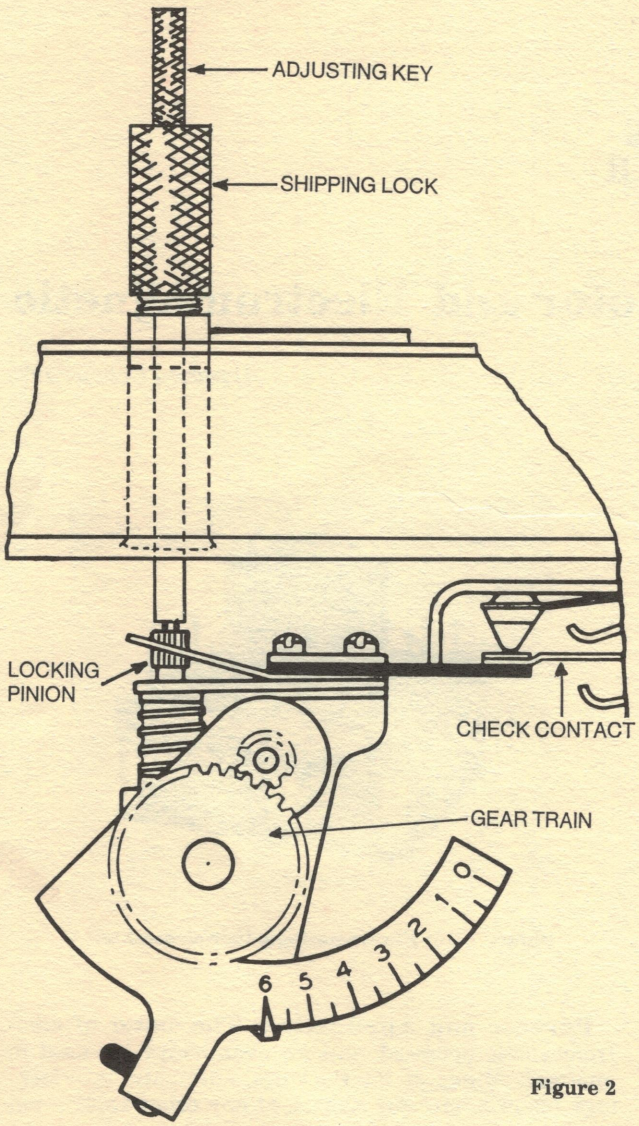


Figure 2

General Information: Only designated personnel should change the setting of a time element relay.

Figure 2 shows the adjusting key in position to adjust the time setting for an electromagnetic time element relay. The adjustment is held by the teeth on the locking spring engaging the teeth of the locking pinion. After the time has been adjusted, the key and cap assembly are removed, the key inverted, and the assembly returned to its position where it must be sealed.

Time settings for motor operated time element relays are obtained by positioning the moveable portion of the timing contactor in the following matter:

The circumference of the calibrated timing gear wheel is provided with gear teeth which are engaged by the intermediate gear when the holding coils are energized. It is through this engagement that the timing motor drive is transmitted to the check and timing contacts. The greater the distance the intermediate gear has to travel along the circumference of this wheel, the greater the length of the operating time before the timing contact closes. Hence, adjusting the position of the movable portion of the timing contactor along the circumference of the timing gear wheel shortens or lengthens this distance and correspondingly decreases or increases the operating time. The calibrations are clearly visible through the transparent cover.

Detailed Operation: Figure 3 illustrates the motor type time element relay. Applying energy to the control wires starts the constant-speed motor, energizes the holding coils, and picks up the armature. This connects the motor, through a gear train, pinion and intermediate gear, to the calibrated timing gear wheel. This wheel carries two contact arms which move with the rotating wheel. One contact arm opens the check contact to prove the relay is energized and the other closes the timing contact when the operating time has elapsed. This second contact arm also opens the motor contact when the time has elapsed. The timing gear wheel remains, with the timing contact closed, until the armature is de-energized.

Upon de-energization, the armature drops and disengages the intermediate gear from the timing gear wheel, permitting the timing gear wheel to restore to normal, opening the timing contact and closing the motor contact and check contact. A time delay is imposed on the drop-away of the armature by copper slugs on the core to bridge the change of its control circuit from a front to a back contact or vice-versa of ordinary acting relays in its control circuit.

The check contact is open from the start of rotation of the timing gear wheel until its full return to normal, providing a check on the relay operation.

Positive armature drop-away and consequent disengaging of the intermediate gear from the timing gear wheel at time of relay de-energization is assured by the adequate dead-weight armature torque that is provided. The timing gear wheel is returned to its normal position and held there by means of a spiral-coiled spring. To prevent rebound and consequent re-opening of the check contact at time of being made, a mechanical snub is provided.

The contactor is solidly attached to, but insulated from the timing gear wheel. As the check contact opens slowly, it is not to be used for interrupting high voltage circuits, and in the case of low voltage circuits it should not be used to open circuits carrying more than 0.5 ampere.

Figure 3 illustrates a schematic operational diagram of a motor operated time relay.

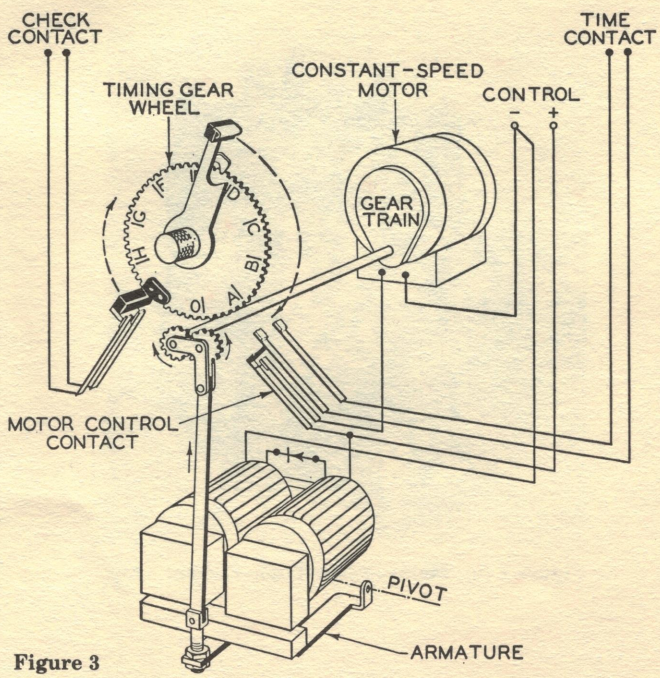
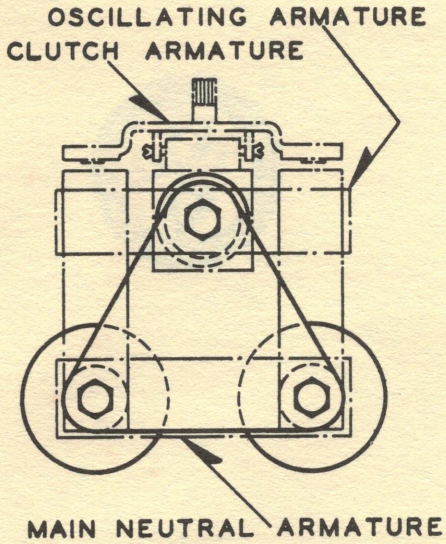


Figure 3



TOP VIEW SHOWING ARRANGEMENT OF COILS.

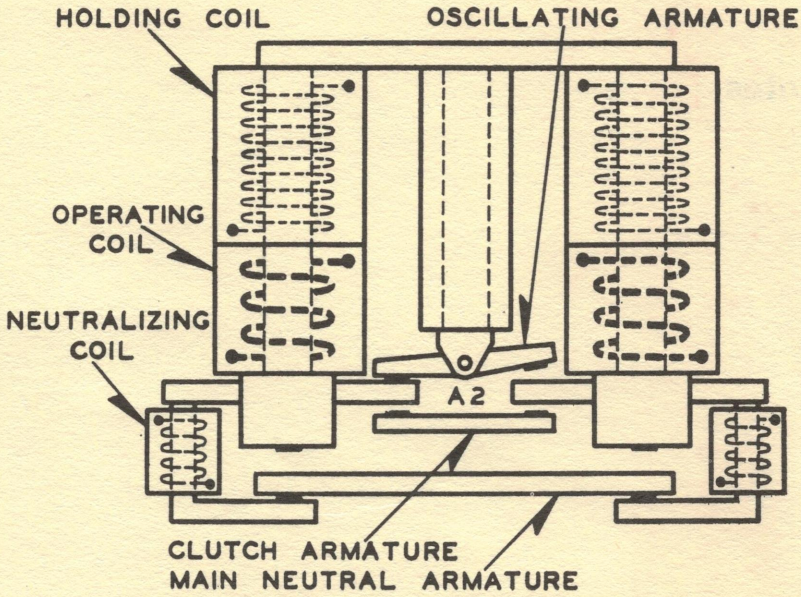


DIAGRAM SHOWING MAGNETIC CIRCUITS.

Figure 4 (a)

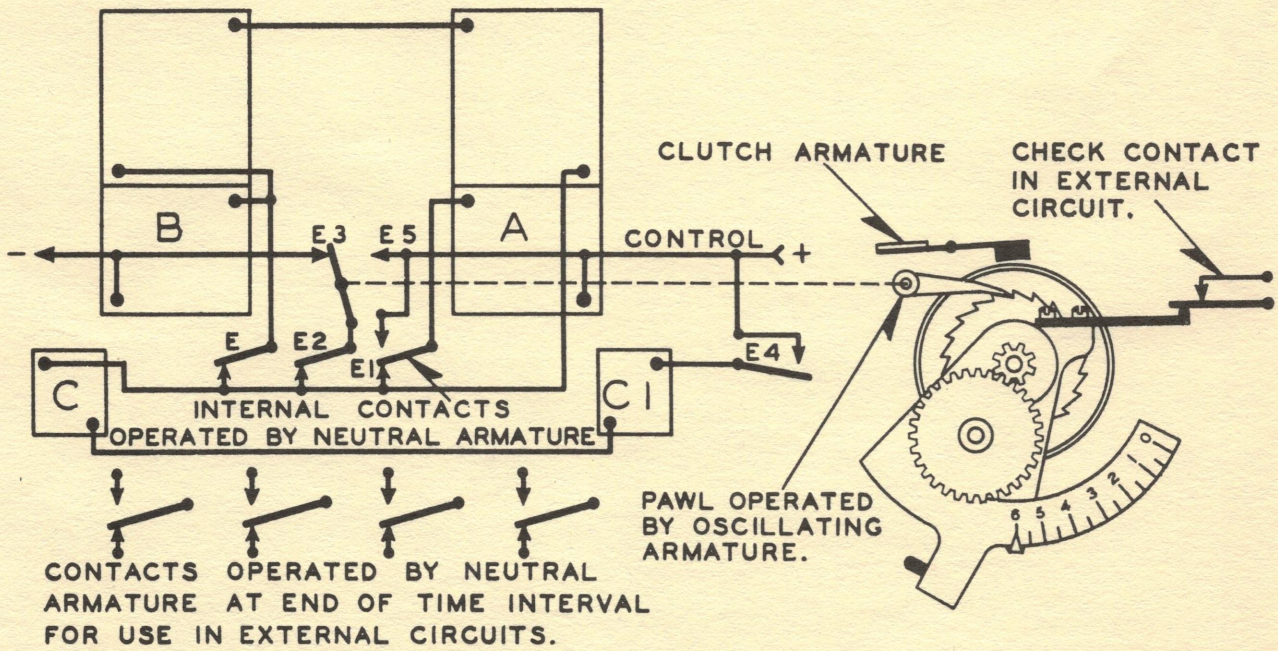


Figure 4 (b)

Figures 4(a) and (b) illustrate the electromagnetic time element relay. Applying energy to the control wires starts the oscillating motion of the oscillating armature, which is converted to a rotary motion by means of a ratchet wheel and pawl which drive a set of planetary gears. The planetary gears are so arranged that when power is applied to the relay a part of the main flux is used to operate a clutch which engages the stationary gear of the planetary system. The operation of the clutch permits the remainder of the planetary system to rotate about the stationary gear until it closes a contact which energizes the auxiliary coils and permits the neutral armature to pick up. When the pick up of the neutral armature occurs, auxiliary contacts are opened, stopping the action of the oscillation armature.

The planetary gear is so arranged that when energy is taken off the clutch holding the stationary gear it releases and allows the gear train to drop to the normal position. A check contact which is closed when the gear train is normal provides a means of indicating that the relay is in proper condition for the next operation.

Figures 4(a) and (b) illustrate the schematic operational diagram of an electromagnetic type operated time relay.

Notes